CLAIMS:

What is claimed is:

1. A method for controlling the movement of particles suspended at an interface between an electrode and an electrolyte solution, the method comprising the following steps:

generating an electric field at said interface between said electrode and said electrolyte solution; and

illuminating the surface of said electrode with a predetermined light pattern to control the movement of said particles in accordance with said predetermined light pattern and electrochemical properties of said electrode.

2. The method of claim 1, wherein said electric field is at least one of a constant and a time varying electric field.

3. The method of claim 1, further comprising a patterning step which is performed using at least one of UV-mediated oxide regrowth, surface chemical patterning and surface charge profiling.

4. The method of claim 3, wherein said patterning step is used to create a plurality of areas of low impedance on said electrode, and said illuminating step is used to selectively connect one or more of said areas of low impedance to cause said particles to move therebetween in accordance with said patterning and said predetermined light pattern.

5. The method of claim 1, wherein the illuminating step comprises the further step of:

illuminating a selected area of said electrode which in conjunction with a frequency of said electric field causes the particles to move into said selected area.

6. The method of claim 5, wherein the frequency of said electric field is adjusted in order to move said particles out of said selected area.

7. The method of claim 1, wherein the illuminating step comprises the further step of:

illuminating a selected area of said electrode surface with a high intensity light pattern so as to cause the particles to move out of said selected area.

8. The method of claim 1 further comprising a patterning step which creates at least two areas of low impedance on said electrode, and said illuminating step being used to selectively cause said particles to move from a first low impedance area to a second low impedance area.

9. An apparatus for implementing the differential lateral displacement of particles suspended at an interface between an electrode and an electrolyte solution, said apparatus comprising:

an electric field generator which generates an electric field at said interface;

an electrode;

an electrolyte solution having a substantially continuous flow which effects the displacement of said particles in a direction substantially parallel to said interface;

an illumination source which illuminates said electrode with an adjustable, predetermined light pattern; and

a plurality of particles located in said electrolyte solution, said particles being in said electrolyte flow and being displaced by said electric field in conjunction with said predetermined light pattern, said particles being displaced in accordance with variations in physical and chemical properties of said particles which determine the mobility of said particles.

10. The apparatus of claim 9, wherein said electrode is a light sensitive electrode.

11. The apparatus of claim 9, wherein said impedance profile is created by a predetermined illumination pattern.

12. The apparatus of claim 9, wherein:

said electrode patterning includes an area of low impedance bordered by an area of high impedance, said low impedance area including a narrow conduit in communication with a wide conduit, both said conduits being oriented parallel to the direction of said continuous flow of said electrolyte;

said wide conduit including a row of intermittently spaced areas of high impedance barriers traversing the width of said wide conduit;

a portion of said plurality of particles being optically distinguishable from the remaining particles;

a detector for visually inspecting said particles traversing the length of said narrow conduit in response to said continuous flow of electrolyte;

said illumination pattern being substantially in the shape of a rectangle having a longer dimension adjusted to be substantially equal to the width of said wide conduit, said rectangle having a smaller dimension which is adjusted to be substantially equivalent to the diameter of said particles, said pattern being located in front of said barriers, and said illumination pattern conforming to an intensity profile placing a maximal value of intensity in the center of said wide conduit and decreasing symmetrically to lower values of intensity at the two sides of said wide conduit; and

a delay activation circuit which activates said illumination profile in response to a signal derived from said visual inspection of said particles so as to cause an illuminated particle to be displaced from regions of maximum intensity to regions of lower intensity of said intensity profile and to be deflected into the intermittent spaces between said barriers.